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THE
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OF
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M,DCC,XLV.

NU

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Luke Gardiner, Eſq;

SIR,

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PERMIT me, then, Sir, to lay this ſmall Tribute at Your Feet, which tho' ſhort, yet I hope to be more plain and intelligible than any other yet Publiſhed on the ſame Subject.

I TAKE this Opportunity of acknowledging Your FAVOURS, and am, SIR, with great Reſpect,

Your moſt Obliged

and moſt Obedient

humble Servant,

C. PHIPPS.

PREFACE.

AS there is no Branch of human Literature more uſeful to Mankind, than the knowledge of Numbers, ſo there is none more Scandalouſly neglected. I have been teaching Writing, Arithmetick and Accounts, above fifty Years in the City of *Dublin*, and in that Time have had more than eleven Thouſand Perſons under my Care; ſome, nay many of them have been, and now are in high

Offices, both in Church and State.

In this long Period *of Time*, many have applied to me for Inſtruction in Arithmetick and Accounts, who were Men employ'd in Buſineſs, and ſuch Profeſſions as require no ſmall ſhare in this kind of Knowledge, and at a Time of Life too, that render'd their Ignorance inexcuſeable.

It were to be wiſhed that all young Gentlemen deſigned for our Univerſity before Admiſſion, were tolerably acquainted with ſo much of this Science, as is neceſſary to prepare them for the Courſe of *Mathematicks*, and Natural Philoſophy that now prevails there, and is (as I am inform'd) the beſt that has been taught ſince the Foundation of that Society. A young Gentleman muſt loſe a conſiderable Time, before he can acquire any tolerable Notion of either, who is a Stranger to Vulgar and Decimal Arithmetick, the Square and Cube Roots, and the Doctrine of Proportions.

I ſhall not preſume to adviſe the Governors of that learned Seminary, but among other Obſervations recommended by that Body, to Gentlemen who have the Education of Youth deſigned for the *Univerſity*, I have been told an Intimation to this Purpoſe would have been kindly received.

But ſince it is not to be preſumed, that Gentlemen who muſt ſubmit to the Labour of teaching the Rudiments of Language are always qualified, or have Leaſure or even Inclination to Lecture their Pupils in Arithmetick; and ſome Schools in the Kingdom, ſuch in particular as are remote from the Capital, or ſituated in a ſcattered Neighbourhood, have not always a Maſter ſufficiently qualified to teach its Rules; I am confident were proper Perſons appointed for the Inſtruction of young Gentlemen after their Admiſſion, the Mathematical and Philoſophical Lecture would become more eaſy to the Pupil, and leſs fatiguing to the Tutor, the One would receive more Information, and Both more Applauſe; and after leaving the College, the former might perhaps fill ſome Station in his Country with as much Pleaſure to himſelf, as Benefit to the Publick.

How far the enſuing Treatiſe may contribute to this Deſign, Experience muſt determine, I do not pretend to carry the Knowledge of Vulgar and Decimal Fractions, farther than has been done before me; I aim at nothing but ſuch a Brevity and Plainneſs as is ſuited to the meaneſt Capacity; however, becauſe it is not impoſſible but that ſome young Gentlemen of ſprightly Imagination, may think the Knowledge of Accounts is requiſite only for ſuch Underlings as Shop-keepers, or Trades-men, but unneceſſary for

Perſons of plentiful Fortunes. To convince them of their miſtake, I muſt beg leave to inform them from Dr. *Wells*'s Preface to his Young Gentleman's Arithmetick, That a Man of Fortune having a conſiderable Eſtate ſeized on for Debt, his Friends being ſurprized at it, deſired him to let them know, by what Means ſo great a Misfortune befel him, he aſſured them, it was principally owing to his not knowing how to *Caſt up or keep his Accounts*, and being unwilling to diſcover his Ignorance, he had been forced to take ſuch Accounts as were brought to him by his Creditor, and thereby had given him the Opportunity to defraud him. A *Notorious* Inſtance, of which we had lately in our Kingdom, but it being ſo well known in our Courts, I ſhall not Name it.

Arithmetick and Accounts are highly neceſſary in all Stations of Life, but more particularly uſeful to *Maſters in Chancery*, Lawyers, Attorneys, *&c.* As moſt of our Law-Suits in this Kingdom are about Property, which makes the Knowledge of Accounts ſo extremely neceſſary for thoſe that have the Conduct and Management of them.

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THE DOCTRINE OF VULGAR FRACTIONS.

AN Unite or Integer is one whole thing, as one Pound, one Shilling, one Yard, one Hour, &c.

A Fraction is a Part or Parts of an Unite, and is repreſented by two Numbers ſet one over the other, with a Line between them thus $\frac{4}{5}$.

The Figure above the Line is call'd or term'd the Numerator, that ſhews the Parts to be taken or us'd, that below the Line is call'd the Denominator, and ſhews the Parts the Unite or Integer is broke into.

THE SEVERAL SORTS OF FRACTIONS.

THERE are 4 Sorts of Fractions, viz. Proper, Improper, Mixt and Compound.

Proper Fractions are ſuch as theſe $\frac{3}{4}$. $\frac{4}{5}$. $\frac{1}{2}$. $\frac{15}{19}$. &c. having the Numerator leſs than the Denominator.

Improper Fractions have the Numerator greater or (at leaſt) equal to the Denominator as $\frac{4}{3}$. $\frac{5}{4}$. $\frac{8}{5}$. $\frac{9}{9}$. $\frac{16}{16}$.

Mixt Fractions are whole Numbers and Fractions ſet together thus $4\frac{1}{4}$ $71\frac{3}{4}$ $6\frac{1}{2}$ &c.

Compound, or Fractions of Fractions, have the Word (of) between them thus $\frac{3}{4}$ of $\frac{4}{5}$ alſo $\frac{5}{8}$ of $\frac{9}{16}$ and $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{3}{12}$ &c.

Reduction

Reduction I.

To Reduce a whole or mixt Number to a Fraction.

Rule.

MULTIPLY the whole Number by any aſſigned Denominator, the Product ſet for a Numerator over the ſaid Denominator, the Fraction thus made, will be equal to the whole Number.

Reduce 12 to a Fraction whoſe Denominator ſhall be 7

12

7 So that 12 is equal to $\frac{84}{7}$

——

84

If it be a mixt Number to be reduced to a Fraction, multiply the whole Number or Numbers, by the Denominator of the Fraction, to that Product add the Numerator, that Sum is a Numerator, to which, ſet under it, the Denominator of the Fraction, which Fraction will be equal to the given mixt Number.

Example.

Reduce $8\frac{5}{8}$ to a Fraction $\frac{69}{8}$ ſo that $\frac{69}{8}$ is equal to $8\frac{5}{8}$

Reduce $16\frac{2}{3}$ to a Fraction $\frac{50}{3}$ ſo that $\frac{50}{3}$ is equal to $16\frac{2}{3}$

Reduce $2\frac{1}{2}$ to a Fraction $\frac{5}{2}$ is equal to $2\frac{1}{2}$

The contrary of this, *viz.* the reducing of an improper Fraction into its equivalent, whole or mixt Number, is effected by dividing the Numerator by the Denominator, the Quotient is the Number of Integers contain'd in the improper Fraction, if any thing remains, ſet it over the Denominator and annex it to the whole Number, ſo it will make a mixt Number equal to the improper Fraction.

Example.

Reduce $\frac{28}{7}$ to a whole or mix'd Number $\frac{28}{7}$ ($\frac{4}{1}$ ſo that $\frac{4}{1}$ is equal to $\frac{28}{7}$ or 4.

Reduce $\frac{36}{6}$ to a whole or mixt Number $\frac{36}{6}$) $\frac{6}{1}$ or 6 is equal to $\frac{36}{6}$

Reduction

Reduction II.

To reduce a Compound Fraction to a Simple Fraction.

Rule.

MULTIPLY all the Numerators continually one into another, the Product is a new Numerator, do the ſame by all the Denominators, the Product is a new Denominator.

Example.

Reduce $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{6}{7}$ to a Simple Fraction $\frac{48}{105}$ is equal to the Compound Fraction.

Reduction III.

To reduce a Fraction to its loweſt Terms.

THE Practical way is, if the Numerator and Denominator in the Unit's Place, both End with a Cypher or 5, then 10, or 5 will divide both Numerator and Denominator of the given Fraction. The Quotient is a Numerator of a new Numerator, and the Quotient of the Denominator is a new Denominator.

Reduce $\frac{1225}{6000}$ to its loweſt Terms

$$\overset{5}{\frac{1225}{6000}} \Bigg| \overset{5}{\frac{245}{1200}} \Bigg| \frac{49}{240} \Bigg|$$

By the loweſt Terms of a Fraction, is meant no more than this, to find another Fraction that has leſs Figures and yet equal in Value, and in order to do this divide the Denominator by the Numerator, if any thing remains, divide the former Diviſor by it, if any thing (after this) remains divide the laſt Diviſor by it, in this Manner proceed till nothing remains, then the laſt Diviſor is a Number that will divide both

Numerator and Denominator without any remainder, and will produce a new Fraction in its loweſt Terms, at once equal to the given Fraction.

Example.

What's the common Meaſure that will reduce the Fraction $\frac{255}{965}$ to its loweſt Terms

255)965(51

193

So that the common Meaſure is 5 and is in its loweſt Terms (viz.) $\frac{51}{193}$.

Reduction

Reduction IV.

To reduce Fractions having different Denominators, to Fractions having equal or common Denominators.

Rule.

MULTIPLY all the Denominators one into another continually the Product is a new Denominator, then multiply the Numerators of the firſt Fraction by all the Denominators except it's own, the Product is a new Numerator for the firſt Fraction, do ſo for the ſecond, third, fourth, &c. Fractions, that is, multiply the Numerators by all the Denominators, except its own, ſetting the ſeveral Products for new Numerators over the common Denominators firſt found, ſo ſhall theſe new Fractions be of one Denomination and equal to the former.

Example.

Reduce $\frac{3}{4}$ and $\frac{2}{3}$ and $\frac{4}{5}$ being Fractions, having unequal or different Denominators, to Fractions having equal or common Denominators.

$$\begin{array}{c|c|c} 3 & 2 & 4 \\ \hline 4 & 3 & 5 \\ \hline \frac{45}{60} & \frac{40}{60} & \frac{48}{60} \\ \hline \end{array}$$

So that $\frac{45}{60}$ is equal to $\frac{3}{4}$ and $\frac{40}{60}$ is equal to $\frac{2}{3}$ and $\frac{48}{60}$ is equal to $\frac{4}{5}$.

If mixt Numbers are thus to be reduced, reduce only the fractional Parts.

If ſeveral compound Fractions are thus to be reduced, they muſt firſt be brought to Single or Simple Fractions by Reduction the ſecond.

Reduction V.

Shews how to change one Fraction into another, which ſhall have any aſſigned Denominator.

Rule.

MULTIPLY the Numerator of the given Fraction by the aſſigned Denominator. The Product divide by the old Denominator, the Quote or Quotient is the Numerator to the aſſigned Denominator.

Reduce $\frac{84}{126}$ to a Fraction whoſe Denominator ſhall be 12.

```
      84
      12
   -------
   ) 1008 (8
     1008
   -------
```

So that $\frac{8}{12}$ is equal $\frac{84}{126}$.

'Tis by this Reduction fifth, the value of any Fraction is found in the known Parts of any Coin, Weight, Time, &c.

Example.

What's the $\frac{4}{5}$ of a Pound Serl. that is, how many 20ths is $\frac{4}{5}$ or change $\frac{4}{5}$ into another Fraction that ſhall have 20 for its Denominator.

So

4
20
―――
5) 80 (16

So that $\frac{16}{20}$ is equal to $\frac{4}{5}$

Note $\frac{1}{20}$ of a Pound is a Shilling, therefore $\frac{16}{20}$ is ſixteen Shillings.

Again, what is the $\frac{5}{9}$ of a Pound Sterling.

5
20
―――
9) 100 (11
―――
1

Having divided, there remains 1 which ſhews it is 11 Shillings and $\frac{1}{9}$ of a Shilling, I therefore next enquire what is the $\frac{1}{9}$ of a

Shilling, that is how many twelfths it is.

$$\begin{array}{r} 1 \\ 12 \\ \hline 9)\,12\,(1 \\ 9 \\ \hline 3 \end{array}$$

And I find it $\frac{1}{12}$ that is 1 *d.* and $\frac{3}{9}$ of a Penny over, then laſtly I ſee how much $\frac{3}{9}$ of a Penny is, that is how many fourths it is.

$$\begin{array}{r} 3 \\ 4 \\ \hline 9)\,12\,(1 \\ 9 \\ \hline 3 \end{array}$$

Which I find to be 1, that is 1 Farthing and $\frac{3}{9}$ of a Farthing over and above, ſo that $\frac{5}{9}$ of a Pound Sterl. is 11 *s.* 1 *d.* $\frac{1}{4}$ $\frac{3}{9}$. Underſtand the like of Time, Weight, Meaſures, &c.

The Reverſe of this is eaſy.

If you would know what Part of a Pound any Number of Shillings, Pence and Farthings is, it is done thus,

Conſider 1 Farthing is the $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound, now $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$ is equal to $\frac{1}{960}$ of a Pound. Alſo 4 *d.* is $\frac{4}{12}$ of $\frac{1}{20}$ of a Pound, now $\frac{4}{12}$ of $\frac{1}{20}$ is equal to $\frac{4}{240}$ of a Pound. The like muſt be underſtood of Meaſure, Time, Weight, &c.

Now if a Compound Fraction be thus to be reduced, it muſt be made a Simple or Single one.

Thus much for Reduction of Fractions.

ADDITION

OF

FRACTIONS.

IF Fractions that have different or unequal Denominators are to be added, reduce them to Fractions having common or equal Denominators, then add the Numerators, and ſet that Sum for a new Numerator over the common Denominator, and you have the Product or Sum required.

Add $\frac{2}{5}$ $\frac{4}{6}$ $\frac{5}{10}$ together,

Reduced, they $\frac{120}{300}$ $\frac{200}{300}$ $\frac{150}{300}$ become thus,

The Sum or Anſwer $\frac{470}{300}$.

If mixt Numbers are to be added, add only the fractional Parts being firſt reduced to the ſame Denomination.

If compound Fractions are to be added, reduce them to Simple or ſingle Fractions, then to a common Denominator, and add them as above.

If Fractions to be added, are not Parts of the ſame whole, tho' of the ſame kind, as thus, the ſum of $\frac{2}{5}$ of a Shilling, and $\frac{3}{4}$ of a Pound are required, that is, the ſum of $\frac{2}{5}$ of $\frac{1}{20}$ and $\frac{3}{4}$ of a Pound Sterl. is required, the Anſwer is eaſy from what is above.

SUBSTRACTION
OF
FRACTIONS.

THE Rules delivered in Addition of Fractions, ſerve in all Reſpects and Caſes for Subſtraction, ſo that having reduced them to one Denomination, ſubſtract the Numerator of the Subſtractor from the Numerator of the Subſtrahend, the remainder or reſidue ſet over the common Denominator, and it is the difference of the two Fractions.

Example.

Subſtract $\frac{1}{6}$ from $\frac{4}{5}$.

Reduce $\frac{5}{30}$ $\frac{24}{30}$ $\begin{array}{c}24\\ \underline{5}\\ 19\end{array}$ Difference:

Remainder $\frac{19}{30}$

MUL-

MULTIPLICATION OF FRACTIONS.

WHEN Fractions are to be multiplied, multiply the two Numerators, for a new Numerator, and the two Denominators, for a new Denominator, theſe two ſet one over the other, make the Product of the two Fractions.

Example.

Multiply $\frac{4}{12}$ by $\frac{6}{7}$ | $\frac{24}{84}$ the Product.

If mixt Numbers are to be multiplied, reduce them to improper Fractions. Upon this depends that of multiplying 4 *s.* 6 *d.* by 4 *s.* 6 *d.* which is no more than $4\frac{1}{2}$ by $4\frac{1}{2}$, or $\frac{9}{2}$ by $\frac{9}{2}$, (which is $\frac{81}{4}$ of a Shilling or 20 *s.* 3 *d.*) by Vulgar Arithmetick it is done thus,

Reduce 4 *s.* 6 *d.* into Pence, which makes 54, that 54 multiplied by itſelf, produces 2916, which is the ſquare of 4 *s.* 6 *d.* underſtand, that any Number multiplied by itſelf, the Product is the ſquare of that Number, now to find the value of 2916, divide it by 144 the ſquare of Twelve, the Product is 20, which is Shillings and 36 remains, which is $\frac{36}{144}$ of a Shilling, which multiplied by 4 produces 144, which Sum divided by 144 produces 1, which is $\frac{1}{4}$ of a Shilling equal to 3 *d.* ſo that by this you ſee 4 *s.* 6 *d.* multiplied by itſelf, produces 20 *s.* 3 *d,* as above.

Note, that 4 *s.* is taken to be Integers, and not parts of a Pound.

But if 10 Shillings were to be multiplied by 10 Shillings, it would produce but 5 Shillings, that is, 10 Shillings is $\frac{1}{2}$ of a Pound Sterl. which multiplied by $\frac{1}{2}$ produces $\frac{1}{4}$ of a Pound, equal to five Shillings; from whence it is plain, that Multiplication of Fractions, decreaſes the value exactly in the ſame Proportion, as whole Numbers increaſe it, as I ſhall ſhew further in Multiplication of Decimals, but it may be asked, how it comes to paſs that 4 *s.* 6 *d.* being multiplied by itſelf, ſhall produce a greater Sum, than 10 Shillings multiplied by 10 Shillings, being more than twice four and ſix pence, the Anſwer is very eaſy and plain, for the 4 *s.* is there taken for 4 Integers or 4 Times one, whereas 10 Shillings is taken for $\frac{1}{2}$ of an Integer, or a Fraction of a Pound Sterl. and not 10 Integers.

If compound Fractions are to be multiplied, Reduce them to ſingle ones.

If a whole Number be to be multiplied by a Fraction, make that whole Number a Fraction by ſetting 1 under it.

Multiply 9 by $\frac{4}{5}$, that is $\frac{9}{1}$ by $\frac{4}{5}$, the Product is $\frac{36}{5}$.

Multiply 75 by $\frac{9}{12}$ (that is $\frac{75}{1}$ by $\frac{9}{12}$, the Product is $\frac{675}{12}$)

DIVI-

DIVISION

OF

FRACTIONS.

MULTIPLY the Numerator of the Dividend by the Denominator of the Diviſor, the Product is a Numerator, then multiply the Denominator of the Dividend, by the Numerator of the Diviſor, and take the Product for a Denominator, the Fraction thus made is the Quotient.

Example.

Divide $\frac{6}{9}$ by $\frac{4}{5}$

$\frac{4}{5})\,\frac{6}{9}\,(\frac{30}{36}$ the Quotient.

Obſerve if Fractions be compound, they muſt be reduced to ſimple or ſingle Fractions.

If they be mixt Quantities, they muſt be reduced to improper Fractions.

A Collection of Queſtions, to Exerciſe the Rules of Vulgar Fractions.

By *Reduction* II.

What part of a Pound Sterl. is $\frac{3}{4}$ of $\frac{2}{3}$.

Anſwer $\frac{6}{12}$ or 10 *s.*

What's $\frac{2}{3}$ of $\frac{4}{5}$ of 18 *s.* Sterl.

Anſwer 9 *s.* 7 *d.* and $\frac{4}{5}$ of a Penny.

A Merchant bought $\frac{2}{3}$ of $\frac{1}{4}$ of a Ship, what part had he of the whole?

Anſwer $\frac{2}{12}$ (or $\frac{1}{6}$.

What's the $\frac{5}{6}$ of $\frac{3}{4}$ of a Guinea at 1 *l.* 2 *s.* 9 *d.*

A Country Gentleman being aſk'd, how many Sheep he had, anſwered he had them in 5 Parks or Fields, in the 1ſt Field there is $\frac{1}{4}$ of my Stock, in the 2d $\frac{1}{6}$, in the 3d $\frac{1}{8}$, in the 4th $\frac{1}{12}$, and in the 5th there is 500, now tell me how many he had?

A Merchant had $\frac{2}{3}$ of $\frac{3}{4}$ of a Ship; another had $\frac{3}{8}$ of $\frac{4}{5}$, which had the greateſt ſhare and by how much?

Decimal ARITHMETICK

NOTATION of DECIMALS.

DECIMALS are Fractions as well as Vulgar, and differ only in this, Vulgar Fractions have any Figure or Figures for their Denominators. But Decimals have always an Unite with one, two, three or more Cyphers annext to it for their Denominators, as 10 100 1000 10000, &c. are all Denominators of Decimal Fractions.

Now becauſe the Denominators of Decimals, differ in the number of Places, and not in the Figures, they may be expreſt without their Denominators, with a Point before them as $\frac{4}{10}$ is thus expreſt .4 and $\frac{7}{100}$ thus, .07 alſo $\frac{\text{[illegible]}}{1000}$ and $\frac{3781}{10000}$ and ſo of any other. So that by this the Denominators of Decimals, are eaſily known by the number of places of the Numerators, the Denominators being always one place more, as 3 hath 10 for its Denominator, and .145 hath 1000 for its Denominator.

The Order of Places in Decimals is contrary to thoſe in whole Numbers, they being from right to left and increaſing, Decimals from left to right and decreaſing, as in this Decimal, .56789 the firſt place next the

Point, is call'd Primes, and denotes ſo many tenth parts of an Unite, the ſecond is ſeconds, and denotes ſo many hundred parts of an Unite, the third is thirds, and notes ſo many thouſand parts of an Unite; ſo that the value of the above Decimal is thus expreſt, fifty-ſix thouſand ſeven hundred eighty-nine hundred thouſands of an Unite. That is divide an Unite or 1 into a hundred thouſand equal parts, and the above Decimal denotes ,56789 of thoſe parts.

From theſe Definitions, it is plain that Cyphers placed on the right Hand of Decimals, do neither increaſe or leſſen their value, for .8 is of the ſame value with ,80000, ſo that it is eaſy to reduce Decimal Fractions to a common Denominator, for it is but putting Cyphers on the right Hand of the Numerators, as .7 .86 .029 are thus reduced to common Denominators, .700 .860 and .029 they having all of them 1000 for their Denominators.

Thus much for Notation of Decimal Fractions.

* * *

ADDITION and SUBSTRACTION OF DECIMALS.

THE Buſineſs of adding or ſubſtracting Decimals, differs from that of whole Numbers only in placing them, therefore take care they are rightly placed, (that is) Primes under Primes, Seconds under Seconds, and then add and ſubſtract in all Reſpects as in common Arithmetick.

Example.

Add 35.147, 654.1, 2.59, 547, 57.25, .579,

Anſwer 1328.634,

Subſtract 524.617 from 3762.348

3792.348
524.617

Anſwer 3267.731

Subſtract .974 from 149.476

149.476
.974

Anſwer 148.502

MULTIPLICATION

OF

DECIMALS.

IN multiplying Decimals, place them, and work in all Reſpects as if they were whole Numbers, then cut from the Product ſo many Decimals (by a Point) as are in both Multiplicand and Multiplier, but in caſe there be not ſo many Places as ought to be cut off, you muſt add ſo many Cyphers, as there wants on the left Hand.

Example

Example.

Multiply 43.5 by .64

```
   43.5
    .64
 ------
   1740
  2610
 ------
 27.840
```

Example II.

Multiply .1676 by .48

```
  .1676
    .48
 -------
  13408
  6704
 -------
 .080448
 -------
```

Again, multiply .213 by .37

$$\begin{array}{r} .213 \\ .37 \\ \hline 1491 \\ 639 \\ \hline .07881 \end{array}$$

DIVI-

DIVISION
OF
DECIMALS.

BEFORE you begin to divide, ſee that the Dividend has more or at leaſt ſo many decimal Places as the Diviſor, if it has not, put ſo many Cyphers as will make it to have the ſaid Property, this done, proceed to operate in all Reſpects as in common Diviſion, then ſee how many decimal Places there are in the Dividend, more than in the Diviſor, for ſo many muſt be cut off from the right Hand in the Quotient.

Example.

Divide 89.943 by .6

```
.6) 89.943 (149.90(
                  3
```

Divide 78975 by 53

In this Caſe you muſt put two Cyphers to the Dividend.

```
53) 7897500 (149009
    53
    ---
    259
    212
    ----
     477
     477
     ----
        500
        477
        ----
         23
```

In this Caſe, you ſee the Quotient is all a whole Number, ſo that the Quotient of any quantity divided by a Fraction, makes the Quotient greater than the whole Number given to be divided.

Where the Dividend conſiſts of Integers and a Fraction, and the Diviſor of Integers only,

Divide 9765.588 by 64

```
64) 9765.588 (152.587
    64
    ----
    336
    320
    ----
     165
     128
     ----
      375
      320
      ----
       558
       512
       ----
        468
        448
        ----
         20 Remainder
```

But where the Dividend conſiſts of Integers and Fractions, and the Diviſor the ſame, the decimal Parts in both being alike, there the Quotient will be all whole Numbers.

Divide 2336.292 by 12.817

```
12.817)2336.292( 182
       12817
       ------
       105459
       102536
       ------
         29232
         25634
         -----
          3598 Remainder
```

The foregoing Examples, I conceive are ſufficient for Diviſion of Decimals.

The Rule of 3 in Decimals, is the ſame as in whole Numbers, only take care to have the Rules of Decimals already delivered in your Head, and all Queſtions will be eaſily anſwered.

A Col-

A Collection of Queſtions ſolv'd by Decimal Fractions.

By *Multiplication.*

In 897 Piſtoles at 18 *s.* each, how many Pounds Sterling.

Anſwer 807 *l.* 6 *s.*

If a Yard of Cloath be worth 19 *s.* what will 562 Yards come to at that Rate.

Anſwer 533 *l.* 18 *s.*

If a Yard of Silk be worth 4 *s.* 6 *d.* what will 365 Yards come to at that Rate.

Anſwer 82 *l.* 2 *s.* 6 *d.*

If the Intereſt of 500 *l.* for one Day is 2 *s.* 3 *d.* what's that for a Year.

Anſwer 41 *l.* 1 *s.* 3 *d.*

Queſtions ſolv'd or anſwered by Diviſion of Decimals.

In 807 *l.* 6 *s.* how many Piſtoles at 18 *s.*

Anſwer 897 Piſtoles.

If 562 Yards of Cloath coſt 533 *l.* 18 *s.* what will one Yard be worth at that Rate.

Anſwer 19 *s.*

If 365 Yards of Silk be ſold for 82 *l.* 2 *s.* 6 *d.* what is one Yard worth of it.

Anſwer 4 *s.* 6 *d.*

If the Intereſt of 500 *l.* for one Year be 41 *l.* 1 *s.* 3 *d.* what is that for one Day.

Anſwer 2 *s.* 3 *d.*

THE ART OF DECYPHERING,

IS an Art not thought of by many, and underſtood but by a few, moſt Men thinking it impoſſible for any one, who ſits down and contrives a Cypher, which he ſends to another, by which he correſponds in an unintelligible Jargon, one of their Letters falls into a third Perſons Hand, how ſhall he read it without the help of the Key; in order to it, I have ſet down ſome Rules, which I hope will make the Thing pretty plain, and will leave the further improvement of it to the more ingenious.

Firſt, ſee how many different Sorts or Marks ſtand for Letters, for 'tis not every Page or Letter a Man writes, will take in the twenty-four Letters of the Alphabet, and you muſt obſerve when you count or reckon the different Sorts or Marks that ſtand for Letters, that the Vowels occur oftener than any other Letters of the Alphabet, there being no one Word in the *Engliſh* Tongue without one of them, and among them the Vowel (E) occurs more frequently than any other Vowel or Letter;

ter; beſides it is ſometimes an initial Letter, but very often a terminate one, therefore when you count the ſeveral Marks or Letters of the Cypher, that which occurs moſt frequent is the Vowel (E).

If a Word conſiſting of three Letters occur often, it is odds but it is *the* or *and*, the former helps to diſcover the latter by the terminate Letter.

If a word of two Letters occur often, it is probably one of theſe Words *of*, *or*, *it*, *is*.

If a ſingle Letter be a Word, it is *A* or *I*, ſeldom *O* never *U*.

If a Word conſiſts of four Letters and begin and end with the ſame Letter, it is a hundred to one it is *that* or *hath*, there being no other common Word in the *Engliſh* Tongue hath the ſame property.

If a Word conſiſting of five Letters, the ſecond and fifth Letters being the ſame, it is the Word *which* no other but itſelf have the ſame quality, the Letters *k x* and *z* ſeldom occur and *q* very rarely.

The common Terminations of ſhort Words are in *d e l m n r* and *s* and often in *T* and *h* ſeldom or ever in *a i* or *u*, long Words commonly end in *ment ble ation* or *ency* and are to be found by their Syllables, in each of which there is always a Vowel, and very often to be diſcovered by their Terminations.

That and *hath* diſcover one another.

Of Initial Letters.

Of Vowels *A* is moſt frequent, *U* next, *E* and *I* equal, *O* laſt, of Conſonants *S* is moſt frequent by far, being alſo more frequent than any Vowel, I mean at the beginning of Words, next to *S* are *C*, *B*, *D*, *F* and *H*. *P T* and *W*, are pretty equal *G*, *L*, *M* and *N*, are not very much behind theſe, but *K*, *Q*, *X*, *Y* and *Z* ſeldom occur at the beginning, or indeed but ſeldom in *Engliſh* Words.

That which makes *S*, ſo common an Initial Letter is, that ten of the Conſonants, *viz.* *C*, *H*, *K*, *L*, *M*, *N*, *P*, *Q*, *T* and *W* will follow it, beſides all the Vowels, whereas no other Conſonant has more than four or five at moſt to follow, *B* has *L* and *R*. *C* has *H* *L* and *R*. *D* only *R*, *F* has *L* and *R*, *G* has *H*, *L* and *R*, but *H* and *N* very rarely. *K* has *N* only. *H* *L* *M* and *N* have none at all but Vowels. *P* has *H*, *L*, *R*, *S* and *T*. *Q* has none, nor any Vowel but *U* only, either at the beginning, or in any other part of a Word that will follow it, which makes it occur very ſeldom. *R* has *H* only, and that but very ſeldom, but has all the Vowels fully. *T* has *H*, *R* and *W*. *W* has *H* and *R*. *Y* has only the four firſt Vowels, no *U* to follow it. *Z*, *E* and *O*.

Where there is a diſtinct Cypher put for *I* and *U*, when they are Conſonants, there they will occur as Vowels ſeldomer than *A E* or *O* at the beginning of Words. At leaſt this is certain of *U*, if not of *I* (as *B C D F G P T* and *W*. Note all the Conſonants have *R*; but S, tho' it has ten that follow it, has never *R*. Next to *R*, *L* and *H* are the moſt common Seconds.

The Vowels have almoſt all the Conſonants except *H* to follow them (which follows rarely) at leaſt all the common ones.

Of Intermediate Letters.

Letters that will not follow one another at the beginning of a Word, will often follow in the middle or end of Words, thus if *R* begins a Word, *N* will no ways follow, and yet they are compatible enough afterwards as may be ſeen in the Words, *Harneſs*, *Burn*, &c.

B	abdicate, abhor, objection, obnoxious, abſent, obtain, *bd*, *bh*, *bi*, *bn*, *bs*, *bt*.
C	*ck*, *cq*, *ct*, *cl*, as acknowledge, acquit, action, incline.
D	*dh*, *dj*, *dm*, *dn*, *dr*, *ds*, *dv*, *dl*, as adhere, adjacent, admit, goodneſs, redreſs, bedſtead, adviſe, bridle.

ſt,

F	*ft*, after.
G	*gl*, *gn*, as ugly ignoble.
H	*hn*, as ſtrengthning.
K	*kl*, as ankle.
L	*lb*, *lc*, *ld*, *lf*, *lg*, *lk*, *lm*, *ln*, *lp*, *lr*, *ls*, *lt*, *lw*, elbow, alchymy, alder, wolfiſh, bulging, bulky, films, alnage, helping, already, alſo, alter, always.
M	*mb*, *mf*, *mk*, *ml*, *mn*, *mp*, *ms*, umbrage, comfort, bumkin, *Hamlet*, damnation, ample, hamſtring.
N	*nb*, *nc*, *nd*, *nf*, *ng*, *nk*, *nl*, *nm*, *np*, *nq*, *nr*, *ns*, *nt*, *nw*, *ny*, unbend, uncaſe, indeed, infringe, drinking, thinly, inmate, unpleaſant, conqueſt, unread, unſaid,

	unſaid, unto, unwiſe, unyoke.
P	*pb*, *ph*, *pm*, *pr*, *ps*, *pt*, *pw*, upbraid, uphold, upmoſt, upright, upſide-down, chapter, upwards.
R	*rb*, *ro*, *rd*, *rf*, *rg*, *rk*, *rl*, *rm*, *rn*, *rp*, *rq*, *rs*, *rt*, *ru*, *rw*, herbal, urchin, hardy, ſurface, purging, barking, ſnarling, ſtormy, tarniſh, carping, cirque, purſes, partake, purvey, ſherwood.
S	*sb*, *sd*, *sf*, *sg*, *Lisbon*, *Thurday*, *Palſgrave*.
T	*tc*, *tl*, *tm*, bitch, butler, nutmeg.
W	*wf*, *wl*, *ws*, lawful, lowly, lowſy.
X	*xl*, ax axle-tree, ax.
Z	*zl*, hazle.

Of

Of Terminations.

In A	Pea, Sea, Tea, Plea, yea, Flea.
E	Innumerable Words.
I	Proper Names only.
O	Proper Names, and who, ſo, to, fro, too, no, tho', ado, ago, two, go, lo, wo, and whoſo.
U	You, lieu, thou and proper Names.
C and Q	None.
X and Z	Rarely but ſhort Words or proper Names.
B, F, G, K, H and W	Often ſhort Words.

Are

D, E, L, M, N, R, S, T and Y } Are very common Terminations and of theſe *E* and *S* are more ſo, both in long and ſhort Words.

Of Duplicates.

Duplicates are moſt common in the beginning, but ſometimes in the middle, and ſometimes in the latter end of Words. The Vowels *E* and *O* are often doubled, eſpecially in ſhort Words, *A* very rarely, *I* and *U* never at all as in *heed, weed, good.* Sometimes *E* is doubled in the end, as free agree, *O* never except in too, coo and woo.

The Words that have Duplicates in the beginning are commonly of *Latin* or foreign original, and ariſe from the Compoſition of theſe Prepoſitions, *ab*, *ad*, *con*, *in*, *ob*, *ſub*, *inter*. Examples Abreviation, Addition, Eccleſiaſtick, Colluſion, Correction, occur, innate, unnatural, illegal, irreverent, aſſuming, Interruption, attribute, *&c.* So that there is not a Conſonant beſides *h*, *k*, *q*, *w*, *x* and *y*, but may admit of a Duplicate from *Latin* Words; but there are many Duplicates alſo that are purely *Engliſh*, as addreſs, affright, boggy, ſtubborn, hammer, allies, Dinner, dipped, hurry, Leſſon, ſmutty, puzzle.

Duplicates are rare after five or ſix Letters, they commonly begin at the ſecond or third Letter, for they never begin a Word, unleſs it be *U* or *I* Vowels, as *jilt*, vulgar, or proper Names, as *Lloyd*, except Eel.

By Compoſition, the Duplicate is ſometimes put at a Diſtance, as Intermiſſion, counterplotting, and ſometimes by joining neſs to an Adjective, thereby turning it to a Subſtantive, as Careleſsneſs, and ſometimes they are the laſt Letter but one, as Legally, Lawfully, &c.

If a long Word end with a Duplicate, it is commonly *ſs*, perhaps ſometimes *l* as unlawfull, but that is not right Spelling, as deferr, unrigg, but ſhort Words often end in Duplicates, as *bleſs*, *kiſs*, *pall*, *will*, *add*, *err*, *ſhall* and *noll*.

Of ſhort and long Words.

It is very eaſy to make an Alphabet of ſhort Words, eſpecially of two or three Letters, if neceſſary, they help to diſcover one another. *A* and *I*, are ſometimes Words, *the* and *and* occur almoſt every Line, and muſt always be ſuſpected when we meet in a Cypher with Words of three Letters; *on* and *no* are reverſed and diſcover each other, *the* when found diſcovers *to*, *be*, *he*, *me*, *we* and *ye*; *as*, *at* and *an*, help to diſcover one another, but the latter is eaſily diſcovered from *and* when found; *for* and *from* aſſiſt each other; *that* and *hath* by their beginning and end-ing with the ſame Letter, diſcover one another, *which* diſcovers itſelf as before, by its ſecond and laſt Letter being the ſame; *all* is a common Word and diſcovers itſelf by its Duplicate, it alſo diſcovers *ill*, or is diſcovered by it; *were*, *when* and *there* diſcover each other; *thy* is diſcovered by *the* as alſo *this* and *thine*; *did* diſcovers itſelf by its firſt and laſt Letter being the ſame, as alſo *ere*, *why* is diſcovered by *which*, as alſo *what* and *when*, as *then* is by *the*, long Words will be eaſily found by Syllables, Duplicates and Terminations.

A Table of four Letters with Duplicates in the middle.

A	Abby, abba, adds, ally, Anna, aſſe.
B	Beer, beef, book, boom, boon, boot, boor.
D	Deed, deem, deep, deer, doom, door.
E	Ebbs, eddy, eggs, errs.
F	Feed, feel, feet, food, fool, foot, feet.
G	Geer, good.
H	Heed, heel, hood, hoof, hook, hoop, hoot.
I	Ills, Inns, Jeer.
K	Keel, Keen, Keep.
L	Leek, leer, lees, look, loom, loon, loop.

M	Meek, mood, meer, meet, moot, moon.
N	Need, nook, noon.
O	Odds.
P	Peel, peep, peer, poor, pool, poop.
R	Reed, reef, reek, reel, rood, roof, rook, room, root.
S	Seed, ſeek, ſeem, ſeen, ſeer, ſees, ſoon, ſoot.
T	Teem, teen, teer, took, tool.
W	Weed, week, weep, wood, wool.
V	Veer.

Theſe Tables are of great uſe, for when you have found the Vowels, they help you quickly to diſcover the Key, and am very confident this one Chapter will eaſily teach any Perſon to diſcover any Cypher conſiſting of a ſingle Alphabet.

The following are Cyphers which were ſent to the Author, one from *Oxford* upon a wager he could not read or Decypher it, the others in *Dublin*, which he read and returned them with their Keys.

The following is from *Oxford*, *Aug.* 14, 1715.

=n =& ks uſ&g.:ekn=us ul &=.:a=::=kr Ngrx:g, nqkn k:: nqg :kn=s fuu+&, aq=tq ag qkeg, n=:: nqg gſo ul N.:k=ks, kſo k:: nqg p.:lgg+ n=:: nqg gſo ul Kk.:te& Ksn us=ſe&, qkeg k n.:eg kſo Eg.:b g&nggrkf:g ek:eg fen nqkn k:: a.:=nngs, &=ſtg,

&c=ſtg, nqkn, n=rg, uag nqg=:.:
x:·:=tg xe:·:g:b nu ue:·: te:·:=u&c=
nb, kſo ſun, nqg=:·:
uas au:·:nq, kſo gmtg::gſtg.

Another in *Dublin*, *May* 23, 1724, upon a Wager of four Pounds Sterl. which he receiv'd.

hco zilzotjouh Xpuoz gxomzo he Rowvgcoi npb, Mur mxx fce zpuwo, Lmghpbr' ei Puyprox Seizhor pu Mzgimqeuh ei quehmxlmu, Rmqmzwe, ei Qmiewwe, ei Hiolpbeur, ei feeq Lpzoimh, zouh yieq Myipw zcemi, fcou Wcmixoqmpu fphe mxx cpz Gooimao yoxx, Lv Yeuhmimllpm

Mrpoj Orſmir Wedo.

Another

Another *Sept.* 5, 1736.

Mr. ***Phipps,***

5† ʜΔ ʙ1oo1u &8568 n1†o Δλz Δ1no1u47Δ
Δλz &1u1 41n5u14 oλ ʙ1oo ʜ1 X†λ8 &870 Δλz
1Xϱ16o14 3λu o81 87ʙ3 Δ17u λ3 ʜΔ ʙλ4215†zn
5† Δλzu 8λzn1 7n 3λu, &870 Δλz ʜ1†oλ† λ3
915†z, 1331u14 7 zz5†17 7 &11X λu n5XoΔ
ϱλz†4 3λu o81 Δ17u, 5a &7n 61uo75†ʙΔ λ331u'4
Δ1z 9Δ nλʜ1 ϱ1unλ† o870 874 ʜλu1 ʜλ†1Δ &c.

The following is a Cypher of another Nature.

a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	ſ	t	u	w	x	y	z
t	u	w	x	y	z	a	b	c	d	e	f	g	h	i	k	l	m	n	o	p	q	r	s

Suppoſe a Perſon were to write *Jackman*, it will ſtand thus by the above Cypher *Ctwdſtg*, and in like Manner any other Name or Words may be written and decyphered thus, and no other Way.

d	u	x	e	g	u	h
e	w	y	f	h	w	i
f	x	z	g	i	x	k
g	y	a	h	k	y	l
h	z	b	i	l	z	m
i	a	c	k	m	a	n
k	b	d	l	n	b	o
l	c	e	m	o	c	p
m	d	f	n	p	d	q
n	e	g	o	q	e	r
o	f	h	p	r	f	s
p	g	i	q	s	g	t
q	h	k	r	t	h	u
r	i	l	s	u	i	w
s	k	m	t	w	k	x
t	l	n	u	x	l	y
u	m	o	w	y	m	z
w	n	p	x	z	n	a
x	o	q	y	a	o	b
y	p	r	z	b	p	c
z	q	s	a	c	q	d
a	r	t	b	d	r	e
b	s	u	c	e	s	f
c	t	w	d	f	t	g

Rule to Decypher the above.

When you have written any Thing by the above Cypher, obſerve the firſt Letter of it, as in the Word which ſtands for Jackman is *Ctwdſtg*, the Letter following C is D, run down through the Alphabet as you ſee, then T the next Letter to it U, run down again, do ſo by all the reſt, and the Word will appear and no other whatſoever.

FINIS.